

WHAT IS CLAIMED IS:

1. A steering system for an outboard motor mounted on a stern of a boat and having an internal combustion engine at its upper portion and a propeller with a rudder at its lower portion powered by the engine to propel and steer the boat, comprising:

5 a swivel shaft connected to the propeller to turn the propeller relative to the boat;

 an actuator connected to the swivel shaft to rotate the swivel shaft; and

 a swivel case rotatably accommodating the swivel shaft, the swivel case being formed with a recess having a box-like shape to accommodate the actuator therein in
10 such a manner that the actuator does not project outside a profile of the outboard motor, obtained by looking down the outboard motor from above in the vertical direction, regardless of a steered angle of the outboard motor.

15 2. A system according to claim 1, wherein the actuator is accommodated in the recess in such a manner that a longitudinal direction of the actuator is positioned on a diagonal of a rectangle of the recess.

20 3. A system according to claim 1, wherein the actuator is accommodated in the recess by supported by supports comprising a first support that supports the actuator at its upper portion thereof and a second support that supports the actuator at its lower portion thereof.

25 4. A system according to claim 1, further including:
 a rotation angle sensor outputting a signal indicative of an angle of rotation of the swivel shaft; and

a controller controlling operation of the actuator based on at least the signal of the rotation angle sensor;

and wherein the rotation angle sensor is installed in the recess.

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5. A system according to claim 1, further including:

a rotation angle sensor that outputs a signal indicative of an angle of rotation of the swivel shaft; and

a controller that controls operation of the actuator based on at least the signal
10 of the rotation angle sensor;

and wherein the rotation angle sensor is installed around an outer periphery of the swivel shaft.

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6. A system according to claim 5, wherein the rotation angle sensor has a ring-like shape and is installed around the outer periphery of the swivel shaft in such a manner that a center of the rotation angle sensor is made equal to a center of rotation of the swivel shaft.

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7. A system according to claim 5, wherein the rotation angle sensor comprises magnets having a ring-like shape fastened to the outer periphery of the swivel shaft and a detection coil fastened to an inner periphery of the swivel case.

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8. A system according to claim 1, wherein the actuator is a hydraulic cylinder and including:

a hydraulic pressure supplier that supplies hydraulic pressure to the hydraulic

cylinder; and

a hydraulic pressure reliever that relieves hydraulic pressure when change of hydraulic pressure of the hydraulic pressure supplier exceeds a predetermined value.

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9. A system according to claim 8, wherein the hydraulic pressure reliever comprises:

a moving orifice installed in the hydraulic pressure supplier; and

a relief oil path installed in the hydraulic pressure supplier connecting
10 hydraulic pressure to an oil tank.

10. A steering system for an outboard motor mounted on a stern of a boat and having an internal combustion engine at its upper portion and a propeller with a rudder
15 at its lower portion powered by the engine to propel and steer the boat, comprising:

a swivel shaft connected to the propeller to turn the propeller relative to the boat;

an actuator connected to the swivel shaft to rotate the swivel shaft;

a rotation angle sensor installed around an outer periphery of the swivel shaft
20 and outputting a signal indicative of an angle of rotation of the swivel shaft; and

a controller that controls operation of the actuator based on at least the signal of the rotation angle sensor.

25 11. A system according to claim 10, wherein the rotation angle sensor has a ring-like shape and is installed around the outer periphery of the swivel shaft in such a manner that a center of the rotation angle sensor is made equal to a center of rotation of the swivel shaft.

12. A system according to claim 10, wherein the rotation angle sensor comprises magnets having a ring-like shape fastened to the outer periphery of the swivel shaft and a detection coil fastened to an inner periphery of the swivel case.

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13. A system according to claim 10, further including:

a swivel case rotatably accommodating the swivel shaft and being formed with a recess to accommodate the actuator therein in such a manner that the actuator does not project outside a profile of the outboard motor, obtained by looking down the outboard motor from downward in the vertical direction, regardless of a steered angle of the outboard motor.

14. A system according to claim 13, wherein the swivel case is formed with the recess having a box-like shape to accommodate the actuator therein in such a manner that a longitudinal direction of the actuator is positioned on a diagonal of a rectangle of the recess.

15. A system according to claim 13, wherein the actuator is accommodated in the recess by supported by supports comprising a first support that supports the actuator at its upper portion thereof and a second support that supports the actuator at its lower portion thereof.

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16. A system according to claim 10, wherein the actuator is a hydraulic cylinder and including:

a hydraulic pressure supplier that supplies hydraulic pressure to the hydraulic

cylinder; and

a hydraulic pressure reliever that relieves hydraulic pressure when change of hydraulic pressure of the hydraulic pressure supplier exceeds a predetermined value.

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17. A system according to claim 16, wherein the hydraulic pressure reliever comprises:

a moving orifice installed in the hydraulic pressure supplier; and

a relief oil path installed in the hydraulic pressure supplier connecting
10 hydraulic pressure to an oil tank.

18. A steering system for an outboard motor mounted on a stern of a boat and having an internal combustion engine at its upper portion and a propeller with a rudder
15 at its lower portion powered by the engine to propel and steer the boat, comprising:

a swivel shaft connected to the propeller to turn the propeller relative to the boat;

a hydraulic actuator connected to the swivel shaft to rotate the swivel shaft;

a hydraulic pressure supplier that supplies hydraulic pressure to the hydraulic
20 actuator; and

a hydraulic pressure reliever that relieves hydraulic pressure when change of hydraulic pressure of the hydraulic pressure supplier exceeds a predetermined value.

25 19. A system according to claim 18, wherein the hydraulic pressure reliever comprises:

a moving orifice installed in the hydraulic pressure supplier; and

a relief oil path installed in the hydraulic pressure supplier connecting

hydraulic pressure to an oil tank.

20. A system according to claim 18, further including:

5 a swivel case rotatably accommodating the swivel shaft and being formed with a recess to accommodate the hydraulic actuator therein in such a manner that the hydraulic actuator does not project outside a profile of the outboard motor, obtained by looking down the outboard motor from downward in the vertical direction, regardless of a steered angle of the outboard motor.

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21. A system according to claim 20, wherein the swivel case is formed with the recess having a box-like shape to accommodate the hydraulic actuator therein in such a manner that a longitudinal direction of the hydraulic actuator is positioned on a
15 diagonal of a rectangle of the recess.

22. A system according to claim 20, wherein the hydraulic actuator is accommodated in the recess by supported by supports comprising a first support that
20 supports the hydraulic actuator at its upper portion thereof and a second support that supports the hydraulic actuator at its lower portion thereof.

23. A system according to claim 20, further including:

25 a rotation angle sensor outputting a signal indicative of an angle of rotation of the swivel shaft; and

 a controller controlling operation of the hydraulic actuator based on at least the signal of the rotation angle sensor;

and wherein the rotation angle sensor is installed in the recess.

24. A system according to claim 18, further including:

5 a rotation angle sensor that outputs a signal indicative of an angle of rotation of the swivel shaft; and

a controller that controls operation of the hydraulic actuator based on at least the signal of the rotation angle sensor;

10 and wherein the rotation angle sensor is installed around an outer periphery of the swivel shaft.

25. A system according to claim 24, wherein the rotation angle sensor has a ring-like shape and is installed around the outer periphery of the swivel shaft in such a manner that a center of the rotation angle sensor is made equal to a center of rotation of the swivel shaft.

26. A system according to claim 24, wherein the rotation angle sensor comprises magnets having a ring-like shape fastened to the outer periphery of the swivel shaft and a detection coil fastened to an inner periphery of the swivel case.